

Application Number: 10/764,797
Amendment Dated: July 12, 2010
Reply to Office Action of: April 14, 2010

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A method for making a mesoporous or combined mesoporous/microporous inorganic oxide comprising the steps of:

a) combining a mixture consisting of a nonaqueous source of an inorganic oxide with an organic complexing and pore forming agent;

b) reacting the source of inorganic oxide with the organic complexing and pore-forming agent at a complexation temperature of from about 150°C to about 250°C ~~formed during the reaction~~ to provide at least one water soluble complex which is thereafter dissolved in water to provide an aqueous mixture, wherein said source of inorganic oxide is an inorganic compound;

c) decomposing the at least one complex to provide a porous material precursor having a mesoporous inorganic oxide framework containing at least some organic complexing and pore-forming agent;

d) recovering and recycling at least a major portion of the organic complexing and pore-forming agent from the inorganic oxide framework by solvent extraction; and

e) calcining the inorganic oxide framework.

2. (Original) The method of claim 1 wherein the source of inorganic oxide comprises at least one inorganic oxide of at least one element of one of Groups IVB, VB, VIB, VIIB, III, IB, IIB, IIIB, VIII, VA, IIIA, IVA, IIA and lanthanide of the Periodic Table of the Elements.

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3. (Original) The method of claim 2 wherein the inorganic oxide comprises at least one oxide of at least one element selected from the group consisting of Si, Al, Ti, V, Cr, Zn, Fe, Sn, Mo, Ga, Ni, Co, Zr, Cu, Mg, Bi, Nb, Mn, Zr, Sb, La, Ce, Te and W.

4. (Cancelled)

5. (Original) The method of claim 1 wherein the source of inorganic oxide is selected from hydrated or unhydrated oxides, hydroxides, nitrates, carbonates, or ammonium salts of at least one metal selected from the group consisting of Si, Al, Ti, V, Cr, Zn, Fe, Sn, Mo, Ga, Ni, Co, Zr, Cu, Mg, Bi, Nb, Mn, Zr, Sb, La, Te, Ce and W.

6. (Original) The method of claim 1 wherein the source of inorganic oxide is silica source, selected from the group consisting of silica gel, silica hydrogel, silica aerogel, and fumed silica.

7. (Original) The method of claim 1 wherein the source of inorganic oxide is aluminum hydroxide or alumina.

8. (Original) The method of claim 1 wherein the source of inorganic oxide is selected from the group consisting of magnesium oxide and magnesium hydroxide.

9. (Previously presented) The method of claim 1 wherein the organic complexing and pore-forming agent is an organic compound having amino groups.

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10. (Previously presented) The method of claim 9 wherein the organic complexing and pore-forming agent is an alkanolamine.

11. (Original) The method of claim 10 wherein the alkanolamine is selected from the group consisting of thiethanolamine, tri-isopropanolamine, tripropanolamine, tris-hydroxymethyleneaminomethane, N,N-dimethylethanolamine and combinations thereof.

12. (Previously presented) The method of claim 1 wherein the organic complexing and pore-forming agent is combined with a glycol solvent.

13. (Original) The method of claim 12 wherein the glycol solvent is selected from the group consisting of ethylene glycol, triethylene glycol, tetraethylene glycol, propylene glycol, tripropylene glycol and tetrapropylene glycol.

14. (Currently amended) A method for making a mesoporous or combined mesoporous/microporous inorganic oxide comprising the steps of:

a) combining a mixture consisting of a nonaqueous source of an inorganic oxide with an organic complexing and pore-forming agent;

b) reacting the source of inorganic oxide with the complexing and pore-forming agent at a complexation temperature ~~formed during the reaction~~ to provide at least one water soluble complex which is thereafter dissolved in water to provide an aqueous mixture, wherein said source of inorganic oxide is an inorganic compound and wherein the complexation temperature ranges from about 150°C to about 250°C, and wherein a preformed microporous zeolite is added to the aqueous mixture;

c) decomposing the at least one complex to provide a porous material precursor having a mesoporous inorganic oxide framework containing at least

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some organic pore-forming agent with the microporous zeolite embedded in said mesoporous inorganic oxide framework; and

d) removing at least a major portion of the organic pore-forming agent from the inorganic oxide framework by solvent extraction and/or calcination to provide a mesoporous or mesoporous/microporous inorganic oxide characterized by an X-ray diffraction pattern having at least one peak at 0.3 to 3.5 degrees in 2θ .

15. (Previously presented) The method of claim 1 wherein the step (c) of decomposing the complex comprises hydrolysis of the complex with an acidic, basic or neutral pH aqueous fluid.

16. (Previously presented) The method of claim 1 wherein the step (c) of decomposing the complex comprises calcining the complex at a temperature of from about 251°C to about 400°C.

17. (Original) The method of claim 1 wherein the solvent extraction comprises immersing the porous material precursor in a solvent selected from the group consisting of water, alcohols, ethers, ketones, esters and combinations thereof.

18. (Previously presented) The method of claim 1 wherein the calcination of step (e) comprises heating the porous material precursor to a temperature of from about 401°C to about 1100°C for a period of time ranging up to about 48 hours.

19. (Original) The method of claim 1 further comprising the step of aging the porous material precursor at a temperature of from about 20°C to about 120°C for a period of time ranging up to about 48 hours.

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20. (Previously presented) The method of claim 19 further comprising the step of drying the porous material precursor after ageing the porous material precursor.

21. (Previously presented) The method of claim 1 further comprising the step of heating the porous material precursor under above atmospheric pressure for a period of time of up to about 4 days.

22. (Previously presented) The method of claim 1 further comprising the step of adding a zeolite to the complex of step (b).

23. (Original) The method of claim 22 wherein said zeolite is selected from the group consisting of zeolite Y, zeolite X, zeolite L, zeolite A, zeolite beta, mordenite, SSZ-32, ZSM-5, ZSM-11, ZSM-22, ZSM-23, ZSM-48, ZSM-58, MCM-22, MCM-36, PSH-3, silicalite-1 and silicalite-2.

24. (Cancelled)

25. (Currently amended) A method for making a mesoporous or combined mesoporous/microporous inorganic oxide comprising the steps of:

a) combining a nonaqueous mixture consisting of an inorganic oxide with an organic complexing and pore forming agent;

b) reacting the inorganic oxide with the organic complexing and mesopore-forming agent at a complexation temperature ~~formed during the reaction~~ to provide at least one water soluble complex which is thereafter dissolved in water to provide an aqueous mixture, wherein the organic complexing and mesopore-forming agent is combined with a glycol solvent;

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~~[[b]]~~(c) decomposing the at least one complex to provide a porous material precursor having a mesoporous inorganic oxide framework containing at least some inorganic complexing and mesopore-forming agent; and

~~[[c]]~~(d) removing at least a major portion of the organic complexing and mesopore-forming agent from the inorganic oxide framework by solvent extraction and/or calcination.

26. (Previously presented) The method of claim 25 wherein the organic complexing and mesopore-forming agent is an alkanolamine. selected from the group consisting of triethanolamine, tri-isopropanolamine, tripropanolamine, tris-hydroxymethyleneaminomethane, N,N-dimethylethanolamine and combinations thereof.

27. (Previously presented) The method of claim 26 wherein the organic complexing and mesopore-forming agent is triethanolamine and the glycol solvent is ethylene glycol.

28. (Previously presented) The method of claim 25 wherein the inorganic oxide framework is characterized by an X-ray diffraction pattern having at least one peak at 0.3 to 3.5 degrees in 2Θ .